SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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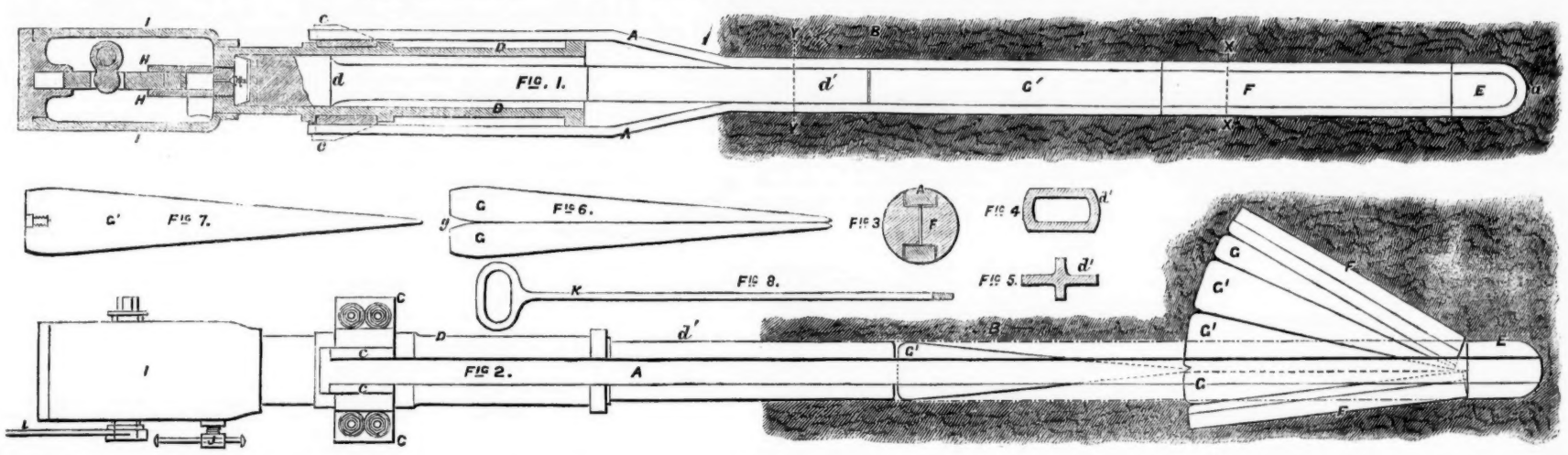
PREVENTION OF COLLIERY EXPLOSIONS—GUNPOWDER AND BLASTING SUPERSEDED.



Many of the most calamitous explosions in collieries have been clearly traced to the ignition of the fire-damp through the firing of shots; and in a still larger number of cases there has been much presumptive evidence of the same cause having existed, although absolute proof was wanting. At the Edmunds Main Colliery the explosion, which it will be recollected resulted in the loss of 60 lives, actually occurred through the blasting operations; and at the Oaks Colliery, only a few miles from it, where some 324 were killed, but little doubt is entertained by practical men that it was to the firing of the shot at the steps to the back workings that that fearful casuality was due. Now, that the use of gunpowder does very much facilitate mining operations is beyond question—the power is easily applied in the desired position, and the amount of work done with a given expenditure of manual labour is sufficiently large to satisfy the workmen. But, valuable as blasting agents are in ordinary cases, it can be readily understood that to explode gunpowder in the immediate neighbourhood of so explosive a gas as that of fire-damp is, to say the least, anything but a safe operation, more especially when conducted, as it is in coal mining, in a comparatively small and enclosed area, from which escape is practically impossible. It cannot, therefore, be surprising that the desirability of abolishing the use of gunpowder in coal mining should have been acknowledged, or that so competent an authority as Mr. George Elliot, M.P. for Durham, in his excellent address to the North of England Institute of Mining Engineers, should have pointed to the discovery of a means of superseding gunpowder in collieries as one of the most important that could be made. In referring to the recent *conversazione* at the Institution of Civil Engineers, we were enabled to notice an invention which appeared to meet the object in view, and described as one of the most interesting exhibits, that by Mr. S. P. Bidder, jun., for breaking down coal, &c., without the use of gunpowder. The invention having now been completely secured by patent we are enabled to publish the subjoined description of it.

Messrs. Jones and Bidder's invention consists in breaking down coal, slate, stone, and other minerals by means of apparatus wherein two or more wedges are caused to be driven consecutively by hydraulic or screw power between the surfaces of the substances to be broken down. The arrangement of apparatus for this purpose may be variously modified, but by preference they employ apparatus constructed as follows:—Two tension-bars or rods, either formed of two separate pieces or of one looped piece, are inserted into the hole cut in the coal or other substance, the outer ends of which bars are connected to the cylinder of a hydraulic ram or press, or to the framing, or screwed nut or boss carrying a screw spindle. Between the tension-bars, at their innermost end, is placed a clearance-box, and then two metal pressing-blocks, between which is afterwards forced first a single wedge by the action of the ram of the hydraulic press, or of the screw spindle; the ram or screw spindle is then withdrawn, and a second wedge is inserted, either between the one side of the first wedge and that of one of the pressing-blocks, or the first wedge may be made as a split wedge, and the second wedge be driven between the two parts thereof, If requisite, a third wedge may in like manner be driven in, and so on until a sufficient wedging action is obtained to effect the breaking down of the mass desired to be removed. The wedges and pressing-blocks may be formed either so as to cause the pressing-blocks while expanding to retain at first a position parallel to each other by making these with inner inclined surfaces, similar to the inclined surfaces of the wedges, or they may be arranged so as to form from the commencement a gradually increasing angle with each other. The wedges can pass beyond the pressing blocks and into the clearance-box, which thus allows them to impart a greater lateral motion to the pressing-blocks than would be the case were the clearance-box not employed; it may, however, in some cases be dispensed with when no great lateral motion is required. The ends of the tension bars are by preference made detachable from the hydraulic press for introducing the wedges consecutively. When the apparatus is worked by hydraulic power they prefer to construct the hydraulic press with the force-pump formed in one therewith or fixed directly thereto, and it may be constructed either with a closed receptacle containing the requisite charge of water for working it, or the water may be supplied through a suction-pipe from a separate reservoir. This arrangement of apparatus may also be employed in some cases with effect with one wedge only, as by forming the pressing blocks parallel—that is, without inclined surfaces corresponding to those of the wedge, as heretofore proposed—they are enabled to obtain an expansion equal to the entire thickness of the wedge, instead of equal only to a small portion thereof, as would otherwise be the case.

The advantages claimed for the improved apparatus, in addition to the absence of the noxious vapours in the mine and the danger resulting from the use of blasting-powder, are—firstly, a great saving in the time employed in effecting the breaking down of the coal or other material, owing to the almost unlimited power which is available by their system, enabling them to break down at one operation far greater masses than can be effected by blasting; and, secondly, the avoidance of the great deterioration of the coal or other mineral which takes place when blasting-powder is used, owing to the large quantities of small fragments or "slack" which are produced thereby. In the above diagrams, Fig. 1 shows a part sectional side elevation of the apparatus; Fig. 2 shows a plan of the same; and Figs. 3 to 8 show details to an enlarged scale. Similar letters of reference indicate similar parts in each of the figures. A A are the tension-bars of wrought-iron, steel, or other metal capable of withstanding considerable tensional strain. These bars may either be formed of one piece bent round at *a* so as to form a loop, or they may be two separate bars connected together at *a*. These bars are inserted into a hole cut in the coal or other mineral B, to be broken down in the manner shown, the ends thereof, which project beyond the face of the mineral, being widened out for the reception of the cylinder, D, of the hydraulic press between them, to which they are connected by T-heads formed at their extremities, being made to catch against lugs *c c*, on a collar C secured to the cylinder. Before the tension-bars are placed in the hole a clearance-box E is first placed between them at the extreme end of the loop, after which the two pressing blocks F F are inserted, the sectional form of which blocks is shown more clearly at the enlarged section of Fig. 3; lastly, the two wedges, or the double or split wedge G G, shown enlarged at Fig. 6, are introduced between the bars A A, so that their points just enter the small interstice between the pressing-blocks. The parts A, E, F, and G thus put together are then inserted into the hole in the material B, and the hydraulic press D is connected to the bars A A, as above described. The press D has a plunger *d d*^{1}, the front part, *d*^{1}, of which projects between the tension bars, A A, as shown, and is formed either as shown in enlarged cross section at Fig. 4, or as at Fig. 5. To the back end of the press D is fixed the pump H, worked by means of the handle L, and enclosed in the reservoir I, containing the water required for working the press. The press being put in action the plunger forces the double wedge G forward between the pressing-blocks F, thereby forcing these asunder in an angular direction, and, consequently, causing them to exert a powerful bursting strain upon the sides of the hole. By forming the inner surfaces of the pressing blocks inclined, corresponding more or less with the taper of the wedge, this first expansion of the blocks may be effected in a more or less parallel direction instead of angular. The object of the clearance-box is to allow of the points of the wedges being driven past the inner ends of the pressing-blocks, so as to effect an increased expansion of these ends; where this is not required the clearance-box may be dispensed with. The double wedge G having been driven into the required extent the press is detached from the tension-bars A, A, which is effected by first opening a passage of communication between the reservoir I and cylinder D by means of the screw J, so as to allow the water to flow from the latter back into the former, after which the press is pushed forward slightly, so as to release the T-heads of the tension-bars from the lugs *c*, whereupon the tension-bars are sprung open and the press removed. Another wedge G^1, shown enlarged at Fig. 7, is now placed between the tension-bars A, A, so that its point fits into the space *g* (Fig. 6), formed between the two parts of the double wedge G. To facilitate the correct insertion of the wedge, for this purpose a handle, K (Fig. 8) is screwed into the rear end thereof, which is removed when the wedge is in position. The press is then again attached to the tension-bars, and the wedge G^1 is forced in between the two parts of the double wedge, thereby effecting a still greater expansion of the pressing blocks; and in like manner one or more other wedges may be consecutively forced in, as indicated at Figure 2, until the accumulated pressure thus produced is sufficient to break down the mass of coal or other material operated upon.

The invention can also be modified so as to employ screw instead of hydraulic power. The arrangement of the tension-bars and pressing-blocks is similar to that used with hydraulic power; but the hydraulic press is replaced by a frame wherein is a slot with a worm-wheel in it, fitting with a female screw thread upon a screw spindle formed with flat upper and lower surfaces, and passing through correspondingly formed holes in the bosses of the frame, so that it can move through but cannot turn in the latter. In gear with the worm-wheel is the worm, the spindle of which is carried by brackets on the frame, the ends of the spindle being formed to receive a ratchet lever for rotating the same. The ends of the tension-bars are formed with lugs, which catch behind keys bearing against other lugs formed on the frame, so that the frame is by this means connected to and disconnected from the frame by merely inserting the keys, and without having to spring open the tension-bars. As the projecting ends of the tension-bars may thus be made considerably shorter than in the previously described arrangement, this mode of connecting the tension-bars might with advantage be employed in that case also. By rotating the worm-wheel by means of the worm the screw-spindle is advanced, and is caused to force the wedge between the pressing-blocks, as in the hydraulic arrangement. Messrs. Jones and Bidder do not limit themselves to the precise details described, as these may, of course, be variously modified without departing from the nature of the invention. Thus, for instance, where only one wedge requires to be driven in the arrangement may be reversed—that is, the wedge may be placed at the inner end of the tension-bars, with its point facing the pressing-blocks situated at the front end, and which are then forced in by the press so as to cause the wedge to enter between them, or the wedge might in that case be drawn forward by the press against the pressing-blocks; but what they specially claim is—firstly, the construction and employment of apparatus for breaking down coal, slate, stone, and other minerals wherein two or more wedges are caused to be driven consecutively by hydraulic or screw power between the surfaces of the material to be broken down, in such manner that the pressure exerted at one and the same point can thereby be increased at will; and, secondly, the arrangement of tension-bars connected in a readily detachable manner to a hydraulic press or frame carrying a screw-spindle, operating in combination with pressing-blocks and one or more wedges.

THE WORKING AND VENTILATION OF COAL MINES.

In the Supplement to the *Mining Journal* of June 12 we published a paper by Mr. J. Warburton on the Economical Working of Collieries, read at a meeting of the Manchester Geological Society. The discussion was resumed on Tuesday, when the several headings of the paper were considered *seriatim*.

Mr. Brigham said he quite agreed with Mr. Warburton's remarks with regard to shafts. He had never found them too large, but often too small. He thought it was better to have the upcast shaft a foot or two larger than the downcast.—Mr. Livsey said, under any circumstances the air must be increased in volume as it passed through the mine.—The Chairman said the shafts in Somersetshire were generally small. He had been down a shaft where a tub of 3½ ft. had stuck; but even there things were improving.—Mr. Brigham said he thought the fewer obstructions in the upcast shaft the better.

The Chairman said the next point in the paper was accommodation at pit bottoms. It seemed to be desirable, in case of accident to the machinery, to have such accommodation, but it was very often expensive to provide it.—Mr. Brigham said there could be no doubt of the convenience of storage at the bottom of the shaft. It often prevented the stoppage of a part of the works when a small accident occurred. When there was coal at the bottom of the shaft the up machinery might be going when the underground machinery was broken. But it was only where they had good strata to deal with that they could provide such accommodation. Where it could be made by all means let them have it.—Mr. Aitken said the question would arise whether the expense would not be larger than the probable benefit derived.

The Chairman said the next point was the size of the tubs or wagons. He thought there were probably those present who, in the course of their ordinary avocations, were brought in contact with tubs of as many different sizes as there were gentlemen in the room. Every gentlemen would, therefore, be able to give some information on the subject.—Mr. Knowles said he thought the tubs should be as light and as low as possible, so that the coal might not be broken in filling or discharging it. A 7-cwt. tub was the most convenient where the seam was about 4 feet thick.—Mr. Brigham said the circumstances under which the tubs were worked were various. He thought it was advisable to employ young men as much as possible in drawing, and when the tub was very large it got beyond their power. To employ two to one tub was in many cases a waste of labour. He agreed with Mr. Warburton, that where there was a good thick seam, and all the circumstances were suitable, as large a tub as possible should be used; but 14 cwts. or 15 cwts. was too heavy. In Wales they had 20-cwt. tubs, but they were drawn by ponies. There were many seams in this district that could not be worked with ponies, and it would, therefore, be thought, be a disadvantage to use large tubs. He found in practice that a tub from 6 to 8 cwts. was most economical in seams of from 4 to 5 feet. In thick seams where horse power could be utilised, it was possible there would be a saving in using large tubs; but in most of the seams he had to do with he thought they would be anything but an advantage.—Mr. Pickup said he agreed that the most convenient size was from 6 to 8 cwts.

Mr. Robson said, with regard to using small corves and tipping them into larger ones on the main road, he tried that, and found considerable disadvantage.

On the question of roads, Mr. Brigham said he quite agreed with Mr. Warburton that they should be as large as possible, but there were limits. It would be unwise to make a large road in a small mine. The roads were in many cases too small, and probably not so economical in the long run as if they were made larger; but there were so many circumstances to be taken into account that it was impossible to fix any specific size. It was a question which could only be determined by a practical man in his own pit.—The Chairman said the question seemed to resolve itself into this—whether in working thin seams it was economical to make large roads for small quantities of coal?

With regard to the getting of coal, Mr. Brigham said his experience in some of the seams he had had to do with showed that there would be a difficulty in carrying out the division of labour suggested by Mr. Warburton. As to the setting of props and laying roads, he thought that would be carrying division too far, because the same men could do both at much less cost than if two sets of men were employed.

Mr. Livsey said as to the holing, the great difficulty he had to contend with was the colliers themselves. They really set up their backs against any innovation. In isolated places it would not pay to keep men to hole, because too much time would be occupied in shifting them from one place to another.

The Chairman said the next point was whether it was better for the men or

set their own timber, or for others to set it for them.——Mr. LIVSEY said if a man could be found full work at timbering in a particular place it would pay; but if he had to go about from one place to another it was more economical for the men to do it themselves. He quite agreed with Mr. Warburton as to the quantity of timber necessary.——Mr. BRIGHAM said he thought the quantity of props necessary was a question which should be left entirely to the man who superintended the putting of them in.

After some remarks on the subject of ventilation, a vote of thanks was passed to Mr. Warburton for his paper; and the proceedings terminated.

MINING IN DEVON AND CORNWALL.

AN ACT FOR AMENDING THE LAW RELATING TO MINING PARTNERSHIPS WITHIN THE STANNARIES OF DEVON AND CORNWALL, AND TO THE COURT OF THE VICE-WARDEN OF THE STANNARIES.—*June* 24, 1869.

Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

PRELIMINARY.

I. This Act may be cited as the Stannaries Act, 1869.

II. *Interpretation of Terms.*—In this Act—

The term "The Stannaries" means the Stannaries of Devon and Cornwall.

The term "The Vice-Warden" means the Vice-Warden of the Stannaries.

The term "The Court" means the Court of the Vice-Warden.

The term "The Registrar" means the Registrar of the Court.

The term "Company" includes any persons or partnership body working a mine in the Stannaries.

The term "Purser" means the purser for the time being of a company, and if there is no purser, then the secretary for the time being, or if there is no secretary, then the principal agent for the time being of a company.

The term "Cost-book" includes all books and papers relating to the business of a mine, which are for the time being kept by a purser, or which, according to the custom of the Stannaries, or the directions of the company, ought to be kept by him.

III. *Extent and Application of Act.*—This Act extends only to mines within the Stannaries, and subject to the jurisdiction of the Court, or within the cognisance of the Vice-Warden; and nothing in this Act shall extend to companies registered under any of the Joint-Stock Companies Acts, except where such companies are expressly mentioned or necessarily implied.

MEETINGS AND PROCEEDINGS GENERALLY.

IV. *Majority in Value at Meeting to Bind.*—Except as otherwise provided by this Act, or by the rules or regulations of any company, a resolution passed at a meeting of the company, by the votes of a majority in value of such of the shareholders as are present in person or represented by proxy at the meeting, shall be deemed the resolution of the meeting, and shall be binding on all the shareholders in the company, whether present or absent, but nothing in this clause shall authorise any ordinary meeting to transact any business which an ordinary meeting could not transact at the time of the passing of this Act, except as is hereinafter provided.

V. *Proceedings with Special Notice.*—Where anything to be done by a company is by this Act required to be done at a meeting with special notice, it shall not be valid if done otherwise than at a meeting notice whereof is served on the several shareholders not less than seven clear days before the day of the meeting, specifying the place, day, and hour of meeting, and the business to be transacted thereat, or so much thereof as is required to be done with special notice.

VI. *Definition of Special Resolution.*—A resolution passed by a company shall be deemed a special resolution within this Act when it has been passed at a meeting with special notice, and has been confirmed at a subsequent meeting with special notice; the last-mentioned meeting being held not less than fourteen days and not more than one month after the meeting at which the resolution was first passed.

VII. *Regulations by Special Resolution.*—A company may, by special resolution passed by not less than three-fourths in value of the shareholders present in person or represented by proxy at the meeting held for the purpose of confirming the resolution to be made special, from time to time alter the rules and regulations for the time being by custom or otherwise governing the company, and make new or additional rules or regulations in that behalf; and any rules or regulations so made by special resolution shall be of the like validity and effect as if they had been made at the original formation of the company; but nothing in this Act shall authorise a company to make rules or regulations inconsistent with the provisions of this Act, or shall abrogate any special rules or regulations existing at the passing of this Act for the management of any company, or shall authorise the making of any special rule or regulation to enable a company existing at the passing of this Act to borrow money.

VIII. *Service of Notices.*—A notice to be served by a company for any purpose of this Act on a shareholder shall be served personally, or shall be served by prepaid letter sent by post addressed to him at his address as entered in the cost-book, in which case the notice shall be taken as served at the time when the letter containing it was put into the post office; and in proving such service it shall be sufficient to prove that the letter was properly addressed and prepaid, and was put into the post office, and the time when it was put in.

As regards a company existing at the passing of this Act, the address of a shareholder as known to the purser at the passing of this Act shall be and remain entered in the cost-book as his address, unless and until he gives notice in writing to the contrary.

ACCOUNTS.

IX. *Entry of Accounts.*—The purser of every company shall, once at least in every four months, truly enter in the cost-book of the company accounts showing the actual financial position of the company at the end of the financial month of the company last preceding the time of entry, including a statement of all credits, debts, and liabilities, and distinguishing in such accounts the amount of calls paid and calls not paid, with accurate lists of all the shareholders for the time being in the company, with their respective addresses, corrected from time to time as occasion requires, and all other accounts, documents, and things which the purser is for the time being required to enter therein by the custom of the Stannaries, or by the directions of the company; and after the passing of this Act all existing or future companies having any rules or regulations touching the management of the company or conduct of the business of any mine, shall file a true copy of them at the office of the Registrar without payment of any fee; and such rules or regulations shall be subject to the inspection of all applicants at reasonable times; and if any company shall neglect to file such rules or regulations as above required, then any shareholder in or creditor of any such company may apply for an order of the Court to file such rules or regulations forthwith, which order shall be enforced by the process of the Court.

CALLS.

X. *Audit and Call.*—At any meeting of a company with special notice the accounts of the company may be audited, and a call may be made.

XI. *Call for Prospective Expenses.*—A call may be made by a company for the purpose of defraying the whole or any portion of the estimated expenses to be incurred at any time within three months after the date of the meeting at which the call is made.

XII. *Discount or Interest on Calls.*—At the time of making a call, a company may direct that discount not exceeding 5 per cent. shall be allowed to every shareholder on payment of the call, at or within the time appointed for payment thereof, and may direct that interest at the rate of 5*l.* per cent. per annum shall be charged on all amounts due on account of a call, and remaining unpaid after one month from the time appointed for the payment thereof.

XIII. *Recovery of Calls, &c.*—The amount for the time being unpaid of any call made after the passing of this Act on any share in a company shall be deemed to be a debt due from the holder of such shares to the company, and if at the time appointed by the company for the payment of any such call any shareholder shall fail to pay the amount thereof, it shall be lawful for the company to sue such shareholder for the amount of such call, in any court of law having competent jurisdiction, in the name of the purser for the time being of the company, whether such purser is a shareholder in the company or not, as the nominal plaintiff for the company, and to recover the amount of such calls, together with interest for the same and costs of suit; and in any action to be brought by the company to recover the amount of such call it shall be sufficient in the declaration or other proceeding in the said action to state that the defendant or (in case of such action being brought against the legal personal representative of a deceased shareholder) that the deceased shareholder was at the time of such call being made the holder of one share or more in the company (stating the number of shares), and that the defendant, or (in case of the death of a shareholder as aforesaid) that the defendant or defendants, as executor or administrator or executors or administrators of such deceased shareholder, is or are indebted to the company in the sum of money to which the calls in arrear and interest shall amount, in respect of one call or more upon one share or more (stating the number and amount of each of such calls), and that the plaintiff is the purser of the company and sues in the action as nominal plaintiff for the company, and on the trial or hearing of such action it shall be sufficient to prove, as a *prima facie* case on the part of the plaintiff, that the defendant or such deceased shareholder, at the time of making such call, was a holder of such one share or more as may be in the company, and that such call was duly made, and that the plaintiff at the commencement of the action was acting as the purser of the company; and it shall not be necessary to prove the appointment or authority of the persons who made such call, or the appointment of such purser; provided, that in case of a change of purser pending the proceedings, the name of the purser for the time being may, by leave of the Court in which the proceedings are pending, or of a judge or proper officer thereof, be substituted for that of a person ceasing to be purser by death, resignation, or otherwise; but no County Court in the Stannaries shall have any jurisdiction under this present clause in any case in which the sum sought to be recovered shall exceed 50*l.*, unless it shall be by law otherwise expressly provided.

TRANSFER OF SHARES.

XIV. *Calls due at Transfer.*—A company shall not be bound to recognise a transfer of a share until all calls made in respect of such share, with interest and expenses, have been paid.

XV. *Transfer of fractional parts of Shares.*—A company shall not be bound to recognise the transfer of a fractional part of a share.

FORFEITURE OF SHARES.

XVI. *Notice on failure to pay Call.*—If a shareholder fails to pay a call on the day appointed for payment thereof, the company may at any time thereafter, during such time as the call remains unpaid, serve a notice on him requiring him to pay such call, with or without interest and any expenses that may have accrued by reason of such non-payment, and stating to the effect that in the event of non-payment in accordance with the notice the share in respect of which such call was made will be liable to be forfeited.

XVII. *Forfeiture on failure to Pay.*—If the requisitions of any such notice as aforesaid are not complied with, any share in respect of which such notice has been given may at any time thereafter, before payment of all calls, interest, and expenses due in respect thereof has been made, be forfeited by a resolution of the company to that effect passed at a meeting with special notice.

XVIII. *Sale of forfeited Shares.*—Any share so forfeited shall be carried to an account to be called "The Account of Forfeited shares," and shall be deemed to be the property of the company, and may be disposed of in such manner as the company thinks fit; and any shareholder may purchase any such share if sold.

XIX. *Evidence of Forfeiture, &c.*—A statutory declaration in writing by the purser of a company that the call in respect of a share was made, and notice thereof given, and that default in payment of the call was made, and that the forfeiture of the share was made by resolution of the company to that effect, shall be sufficient evidence of the facts therein stated as against all persons entitled to such share, and such declaration, and the receipt of the purser for the price of such share, if sold, shall constitute a good title to such share, and the purchaser shall be entered in the cost-book as a shareholder in respect of the share, and thereupon he shall be deemed the holder of such share, discharged as against the company from all calls due prior to such purchase, and he shall not be bound to see to the application of the purchase money, nor shall his title to the share be affected by any irregularity in the proceedings in reference to such sale.

XX. *Payment notwithstanding Forfeiture.*—Any shareholder whose share has been forfeited shall nevertheless be liable to pay all calls, interest, and expenses payable on or in respect of the same at the time of forfeiture.

RELINQUISHMENT OF SHARES.

XXI. *Disposal of Relinquished Shares.*—Where a share in a company is relinquished, it shall be carried to an account to be called "The Account of Relinquished Shares," and shall be deemed to be the property of the company, and may be disposed of as the company thinks fit, and any shareholder may purchase any such share if sold.

XXII. *Relinquishment to be in Writing.*—Every relinquishment of a share shall be by notice in writing delivered to the purser, but a company shall not be bound to recognise the relinquishment of a fractional part of a share.

XXIII. *Evidence of Relinquishment, &c.*—A statutory declaration in writing by the purser of a company that a share has been relinquished shall be sufficient evidence of the facts therein stated as against all persons interested in the share, and that declaration, and the receipt of the purser to a purchaser of the share for the price thereof if sold, shall constitute a good title thereto, and the purchaser shall be entered in the cost-book as a shareholder in respect of the share, and thereupon he shall be deemed the holder thereof, discharged as against the company from all unpaid calls, interest, and expenses due to the company in respect thereof accrued before his purchase, and he shall not be bound to see to the application of the purchase money, nor shall his title to the share be affected by any irregularity in the proceedings in reference to such sale.

SALE OF MINE.

XXIV. *Power of Sale of Mine, &c., as going concern.*—Without prejudice to the landlords, lessors, or others having any estate, charge on, or interest in the land in which the mine is situate, or to the creditors, and their customary lien on the saleable machinery and materials belonging to the company, a company shall have power, by a special resolution to which three-fourths in value of the shareholders shall consent, either in writing or at a meeting, to sell and dispose of the machinery and materials belonging to the company, with or without the legal or equitable interest of the company in the leases or sett on which any mine belonging to the company is worked, as a going concern, provided that every such sale shall be by public auction, and that due notice of the intended sale be given by public advertisement in some local newspaper, and in some public journal or newspaper specially relating to mining companies, for two successive weeks before the sale.

WINDING-UP.

XXV. *Limitation of Liability of Past Shareholders.*—On a company being wound-up in the Court of the Vice-Warden, or any other Court, a former shareholder, notwithstanding the provisions contained in the Companies Act, 1862, part 8, sect. 200, shall not be liable to contribute to the assets of the company if he has ceased to be a shareholder for a period of two years, or upwards, before the mine has ceased to be worked, or before the date of the winding-up order.

WAGES OF MINERS.

XXVI. *Wages of Miners, &c.*—On a company formed for, or engaged in, working a mine (including a company registered under any of the Joint-Stock Companies Acts) being wound-up in the Court of the Vice-Warden, or any other Court, or otherwise, the date of the winding-up order having been not earlier than two months after the passing of this Act, then and in every such case the amount (if any) due at the date of the winding-up order to miners, artizans, and labourers employed, wholly or in part, in or about the mine, in respect of their wages or other earnings in relation to the mine, not exceeding three months' wages or earnings to each such person, shall be paid in priority to all other debts of the company.

PROCEDURE OF THE COURT.

XXVII. *Affidavits used in the Court.*—Whereas since the passing of the Act 18 Vict., chap. 32, for amending and extending the jurisdiction of the Court of the Vice-Warden, and of the Companies Act, 1862, the experience of the Court has suggested the expediency of some amendment of the provisions of those Acts, so far as they relate to the Stannaries and the jurisdiction of the Court: Be it enacted, that all affidavits, affirmations, and declarations shall be available in suits, causes, and matters in the Court, although not sworn, made, and taken by or before a Commissioner of the Court; provided the same shall have been sworn, made, or taken by or before any Commissioner authorised to administer oaths in the superior courts of equity or of common law in England or Ireland, or in the Isle of Man, or the Channel Islands, or by the officers exercising like powers to administer oaths in Scotland, or by any of the Courts, judges, or other persons having like authority in the dominions of the Crown beyond seas, or in foreign parts, specified or described in the Act 15 and 16 Vict., chap. 86, sect. 22, and the Act 16 and 17 Vict., chap. 78; and the Vice-Warden or Registrar shall, on the production before him of such affidavits, affirmations, or declarations, purporting to be duly and regularly sworn, made, or taken by any of the Courts, or persons hereinbefore referred to, presume the same to have been so sworn, made, or taken, unless the contrary be proved to his satisfaction; and in case of wilful and corrupt false swearing, affirming, or declaring in such document so produced, or of the production or use by any party of such document, knowing the same to be a forged or spurious one, the offender shall be liable to all the penalties, punishments, and consequences specified in the sections 23 and 24 of the Act 15 and 16 Vict., chap. 86: Provided also, that all lawful fees due and demandable upon swearing, making, or taking such affidavits, affirmations, or declarations, by or before any of the Courts or persons above referred to, shall be paid or tendered to such Court or person by the party applying for such document.

XXVIII. *No Demand necessary before Enforcing Order to Pay, Produce, or Deliver.*—Whenever a decree or order of the Court for payment of money, or production, or filing, or delivery up of any books, papers, deeds, or accounts, or the delivery up of property, real or personal, shall have been made in a suit or matter whereof the said Court has cognizance, no formal demand shall be necessary, but the person or party who shall have been so decreed or ordered to pay such money, or produce, or file, or deliver up such documents or property, on being duly served with such decree or order, shall be bound to obey the same, and process shall thereupon issue to enforce performance, without further special application to the Court.

XXIX. *Enforcing Process through the Registrar of a County Court.*—In enforcing execution of any judgment, decree, or order of the Court by writ sent to the Registrar of any County Court under sections 9 and 10 of the Act 18 Vict., chap. 32, the person or party entitled to recover any moneys awarded to him by such judgment, decree, or order, may issue such process to the County Court, although the sum sought to be recovered may exceed 50*l.*, provided the sum do not exceed 250*l.*, including the costs of applying to the Court for leave to issue such execution, where such leave shall be necessary by the rules of the Court; and such process shall hereafter be available to any party entitled to levy such money, not exceeding the said sum of 250*l.*, by a like writ of execution sent to the registrar of any County Court within the Stannaries, as well as beyond the Stannaries, subject to the payment of all lawful fees for execution in such County Court, and subject in other respects to the provisions of sections 9 and 10 of the Act last above mentioned, except that the judge of a County Court within the Stannaries may, if he thinks fit, remit any claim of interpleader arising on the execution of such writ for determination by the Court.

XXX. *Execution of Process of Attachment within the Stannaries.*—If any person residing or being within the Stannaries shall be in contempt for disobedience of any order of the Court other than for the payment of money leviable by the ordinary civil process of the Court, and be thereupon attached by the bailiffs of the Court, or by a messenger or messengers of the Court specially named or appointed by the Court for execution of the writ of attachment issued by the Court, such bailiffs or messengers shall forthwith take into their custody the person so attached, and bring him with all convenient speed to Truro, there to be examined by or before the Vice-Warden, if he shall then be sitting at Truro, or before the Registrar there, touching the matter of his alleged contempt; and upon such examination the Vice-Warden or Registrar shall, if the offender shall have sufficiently cleared himself of the contempt, discharge him out of custody, or if shall not have so cleared himself shall commit him to the common gaol at Bodmin, or, in case of contempt within the Stannaries of Devon, to the borough gaol at Plymouth, there to remain until he shall have submitted to the order of the Court, or shall be otherwise discharged in due course of law; and such writ of attachment, and any commitment thereon, shall issue in the name of the Lord Warden of the Stannaries, with the seal of the Court attached.

XXXI. *Service of Process, &c., beyond the Stannaries.*—Whereas the service of process on the common law side of the Court in any part of England without the special order of the Vice-Warden has been found inconvenient, and in some cases liable to abuse. Be it enacted, that no such service of process out of the limits of the Stannaries, in suits or plaints on the common law side of the Court, shall hereafter be effected without the special order of the Vice-Warden, made on a statement of the nature and object of such suit or plaint, except in the case of actions of ejectment brought under the authority of section 15 of the Act 18 Victoria, chapter 32.

XXXII. *On Appeals to the Lord Warden a Deposit to be made.*—In all cases of appeals against any judgment, decree, or order of the Court, besides the bond to the Registrar required by the Act 18 Vict., chapter 32, section 26, a deposit of 20*l.* shall be made in the hands of the Registrar, to be paid to the opposite party when the judgment, decree, or order is not reversed, unless the Court shall otherwise direct; and if the appeal against any decree or order be prosecuted in the name or on the behalf of any registered company with limited liability, or in the name or on the behalf of any person who has recently become bankrupt, or has executed any unsatisfied deed of arrangement, composition, or inspectorship under any Bankruptcy Act, the Registrar of the Court may require that a sufficient surety be joined as co-obligor in the bond which the appellant is bound to give in such case, who shall be personally liable to pay the taxed costs of the appeal to the extent of 50*l.*, if the judgment, decree, or order be not reversed; and the appellant shall also deposit in the hands of the Registrar the sum of 20*l.*, payable as herein-above directed in the case of ordinary appeals.

XXXIII. *Duties of Registrar in Liquidation of a Company.*—Where an order is made for the winding-up a company in the Court, whether the same be a registered or an unregistered company, and no official liquidator is appointed, the Registrar shall have authority, with the sanction of the Vice-Warden, to perform all the ordinary duties of an official liquidator, and to exercise all the powers assigned by the Companies Act, 1862, to such liquidator, so far as such duties or powers are not incompatible with his official duties as Registrar.

Provided always that the Registrar shall not in such case be called upon to give any such security as may be required of an official liquidator under section 92 of the last-mentioned Act, unless the Lord Warden of the Stannaries or the Vice-Warden by some general rule of the Court shall otherwise order, nor shall he be entitled to any remuneration for the performance of the said duties other than the salary now received by or that may hereafter be assigned to him in his official character of Registrar; nor shall it be necessary for him to use the name or style of official liquidator, nor any other style than that of Registrar, unless it shall become necessary for him to take out letters of administration to any deceased contributory; and in proving a debt due from any contributory who shall have become a bankrupt within the intent and meaning of section 87 of the Companies Act, 1862, a certificate of the debt signed by the Registrar, with the seal of the Court attached, shall be accepted in the Court of Bankruptcy as sufficient proof of such debt as against the estate of the bankrupt, without requiring the oath or affidavit of the Registrar.

Provided, also, that the Registrar in the performance of such duties and exercise of such powers shall not be liable to any penalty prescribed by the said Companies Act, 1862, and imposed on official liquidators as such, or become personally liable in respect of any act done or proceeding taken by him by the order or authority or with the sanction of the Vice-Warden acting in his judicial character.

XXXIV. *Attachment of Debt due to a Contributory on Winding-up.*—In cases where several companies are in course of liquidation by or under the superintendence of the Court, if it shall appear to the Vice-Warden that a person who is a contributory of one of the said companies is also a creditor claiming a debt against one of the other companies, the Vice-Warden may, in his discretion, and after due enquiry

into the facts, direct that the said debt, when allowed, shall be attached, and payment thereof to the creditor suspended for a time certain, as a security for payment of all or any calls that are or may in course of liquidation become due from him to the company of which he is a contributory, and the amount thereof shall be applicable and applied to such payment in due course, provided that no such order of attachment shall prejudice any claim which the company so indebted to him as creditor may have against him by way of sett-off, counterclaim, or otherwise, or any lawful claim of lien or specific charge on the said debt in favour of any third person.

XXXV. *Fraudulent Transfers of Shares.*—A transfer of shares made for the purpose of getting rid of the further liability of a shareholder, as such, for a nominal or no consideration, or to a person without any apparent pecuniary ability to pay the reasonable expenses of working a mine, or to a person in the menial or domestic service of the transferror, shall be presumed to be a fraudulent transfer, and need not be recognised by the company, or by the Court on the winding-up of the company, whether the company be a registered or unregistered company.

XXXVI. *Jurisdiction to Restrain Sales of Setts.*—The jurisdiction of the Court to grant injunctions restraining sales of machinery and other effects on mines is hereby extended, so as to authorise the granting of injunctions restraining sales of setts where equity so requires, and the jurisdiction conferred by this section may be exercised in creditors' suits, or on the application of a shareholder in a company.

XXXVII.—*Issuing Injunction Orders by the Registrar in certain cases.*—It shall be competent for the Registrar, on the application of either a creditor or a shareholder, to issue injunction orders in customary creditors' suits pending in the Court, and to forbid the sale of setts, leases, machinery, or other effects on or belonging to the mine on the usual allegation of urgency, or to issue such orders in other cases of like urgency or imminent waste or damage to property; and in such cases the party or parties so enjoined may appear and show cause before the Registrar, and apply to him to suspend or dissolve the order; but such application to the Registrar shall not be exclusive of the existing power of the Vice-Warden to issue such orders, though he may not then be sitting within the Stannaries, nor prevent him from reconsidering the order of the Registrar, on the motion or complaint of any of the parties interested in it.

XXXVIII. *Hearing of Petition for Winding-up.*—The provision of section 83 of the Companies Act, 1862, contained in second paragraph thereof, shall be amended and read as follows—namely, that the Vice-Warden may direct that petitions to wind-up a company shall be heard by him at such time or place as he may think fit within the Stannaries, or within or near to the place where the registered or other chief office of the company is situate, or if such office be distant 150 miles or more from Truro (measured by the public railways), then in London or Westminster; or, with the consent of the party or parties petitioning, and of the company represented by its secretary, purser, or other proper officer, the hearing may be in any part of England; and all orders made by the Vice-Warden on such hearing in any of the above cases shall be as valid and effectual as if they had been made at Truro.

XXXIX. *Adjournment of Sittings and Appointment of Deputy Vice-Warden.*—Sections 7 and 8 of the Act 2d and 3d Vic., chap. 58, and the Section 24 of the Act 18th and 19th Victoria, chapter 32, are hereby repealed; and in lieu thereof be it enacted, that if in consequence of illness, or accident, or other disability, the Vice-Warden shall not attend at Truro on the day and time appointed for his sittings there, the Registrar shall have power to open the Court, and adjourn the sittings to some other day, on which adjournment day all persons summoned or bound to attend the sittings shall be in attendance, as if the Vice-Warden himself had adjourned them; and if by reason of such illness, accident, or other disability, or for any other cause deemed by the Lord Warden to be a reasonable cause, the Vice-Warden shall desire to appoint a deputy for a time certain, not exceeding six months, he may, with the approval of the Lord Warden, appoint such deputy, being a barrister of five years standing and not less, with all the powers and judicial functions of the Vice-Warden himself; and if the Vice-Warden shall, by reason of such illness, accident, or disability, be unable or shall neglect to make such appointment, it shall be competent for the Lord Warden of the Stannaries to nominate such temporary deputy, with the qualification, powers, and functions aforesaid, with such directions touching the remuneration of such deputy as he may think fit.

XL. *Provision for a Temporary Registrar on a Future Vacancy.*—Whereas inconvenience may hereafter be occasioned by the death of the Registrar and the delay in appointing a successor, be it enacted that the Vice-Warden for the time being shall in such case have power to employ the assistant registrar, if there be one, or any other competent person, being a clerk or officer of the Court, to execute, under the direction of the Vice-Warden, all or any of the necessary duties of Registrar, until such time as the successor of the deceased Registrar shall have been duly appointed, and such temporary Registrar may, if the Lord Warden shall think fit, be remunerated for such extra duty out of the salary accruing between the decease of the last Registrar and the appointment of his successor, who shall be entitled to receive the balance (if any) of the salary so accruing during that interval.

XLI. *Provision as to Half-Yearly Remissions.*—From and after the passing of this Act, the whole of the several provisoes contained in sect. 30 of the Act 6 and 7 Will. IV., cap. 106, and in sect. 36 of the Act 18 and 19 Vict., cap. 32, respectively, which in any way relate to, or empower, or require half-yearly remissions of the assessment, in such provisoes respectively mentioned or referred to, shall be and the same are hereby repealed, and thereupon the moneys accruing by reason of such remission shall be applicable and be applied to such of the several purposes specified in sect. 172 of the Companies Act, 1862, touching the application of the fees arising under proceedings taken for winding-up mining companies, as the Lord Warden of the Stannaries shall from time to time, on the application of the Vice-Warden or otherwise, think fit to direct, sanction, or assign, and meanwhile shall accumulate by investment, as to the whole or part of the accruing moneys, in the manner directed in and by the provisions of that section.

XLII. *Vacations in the Court.*—Whereas by the Act 6 and 7 Vict., cap. 106, sect. 17, the Court is, for the purpose of the entry of pleadings, orders, proclamations, and other matters touching practice, process, or execution, to be at all times open, except on Sunday, Christmas-day, Good Friday, and days of public fast or thanksgiving, and no other days or times are specified wherein the Court or its offices may be lawfully closed, nor is any period of vacation for the Court or its officers and clerks provided: Be it enacted, that the Court and offices may hereafter be closed on Christmas-day and the six following days, on Good Friday and the six following days, and that the space of six consecutive weeks, beginning on Sept. 1 in every year, shall be deemed to be the vacation of the said Court, during which the attendance of the officers of the Court will be dispensed with; so nevertheless that during the continuance of those days and times, and the above vacation, provision shall be made for the receipt and payment or payments of money by or to the proper officer of the Court, whereof due notice shall be from time to time given; Provided also, that during such times and vacation applications may be made for injunction orders, either to the Vice-Warden or to the registrar, in any part of England, whether within or beyond the Stannaries.

XLIII. *Power to make General Rules and Orders.*—The powers contained in the Act 18 Vict., cap. 32, sects. 23 and 26, for making general rules and orders of the Court touching the procedure, practice, pleading, court fees, taxation of costs, and forms on the equity and common law side of the said Court, and other business of the said Court, and also touching the regulation of the practice, fees, and costs of appeals pending before the Lord Warden of the Stannaries, whether heard by and before himself, or remitted by him for the determination of the Judicial Committee of the Privy Council, or to the Court of Appeal in Chancery, shall be deemed and taken to extend and apply to this Act, and to the several provisions contained herein. Rules and orders made in pursuance of the powers contained in the said Act or in this Act with respect to fees shall be made only with the sanction of the Commissioners of Her Majesty's Treasury.

XLIV. *Officer not entitled to Compensation in case of Alteration of Duties or Abolition of Office.*—A person shall not be entitled to any compensation in respect of any emoluments received by him for duties performed in pursuance of the provisions of this Act, or in respect of the emoluments of any office in or connected with the Court, or with the Lord Warden of the Stannaries or Vice-Warden, to which such person is appointed after the passing of this Act, in case any alteration is made in such duties or in the duties of such office, or in case such duties or such office are abolished.

SAVINGS.

XLV. *Saving for Existing Creditors.*—Nothing in this Act shall take away or abridge any right or remedy of any creditor of a company existing at the passing of this Act.

XLVI. *Saving for Customs of Stannaries, &c.*—Nothing in this Act contained shall exclude the right of any shareholder of a company, miner, creditor, or other customary suitor of the Court to resort to all or any of the remedies heretofore used and enjoyed, and still subsisting by custom or statute in the said Court as now constituted by law unless such right is expressly abrogated by this Act.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURES LVIII., LIX., AND LX.—Continuing his notice of the processes employed in "dressing" the ores for market, Mr. SMYTH said that in well-managed mines a great amount of separation was carried out below the surface. He had in an earlier lecture described the arrangements in the levels for this purpose, by which tip-plats were made, in which the different materials could be divided, and readily tipped into different places. In this way most of the attle was left below, and the cost of winding reduced. The orey material then being raised to the surface was subjected to what was called "spalling," by which it was broken down to various sizes, according to circumstances and the nature of the ore. Formerly this was almost entirely done by hand, and the men generally were paid by fixed bargains at so much per ton. It was often very hard work, but the spaller, by long experience, acquired the best modes of dealing with the masses before him, and got through a large amount of work. This, however, is not only a laborious but a slow process, and machinery of more or less simplicity of construction is now largely introduced in spalling. The nature of these machines may be best understood by examining the construction and action of Blake's stone-breaker, which breaks up the hardest stone with great facility, and gets through a large quantity of material with cheapness and dispatch. Of course, when steam or water power is available these machines can be employed to greater advantage. The mine manager, however, should be careful to select the apparatus to be employed in spalling and crushing with special reference to the nature of the material, and the state to which it is to be reduced. Thus, in some cases it might be desirable to reduce the mass to a fine powder, while in others to do so would be greatly to depreciate the value of the ore. To give an idea of what was required they might imagine a man cracking a nut with a hammer. What he would try to do would be to give just such a blow as would break the shell, and leave the kernel untouched; on the other hand, if he struck with force enough to crush both shell and kernel the nut would be spoilt. So in spalling and crushing the ores must be broken to a size suitable to the after operations to which they have to be subjected, as, for instance, some ores may be reduced to pieces the size of walnuts, and others to smaller grains, although not to a powder. The simplest implement used in this work was the mortar and pestle, employed when the quantity to be broken up was but small, and when the trituration and amalgamation of the precious metals were concerned. In the outlying mines of Australia, California, and Transylvania an apparatus of that kind came in very usefully, as it answered the double purpose of partly triturating and partly amalgamating the ores, and thus a man accustomed to the work, and having an iron mortar and pestle, would be able to impart the particular kind of movement best suited for effecting trituration and amalgamation. A very convenient little machine of the same class was used with considerable success at the Dolgelly Mine. It was known as "Britten's machine," a man of that name having been the inventor. Another mode of grinding was that of having large "edge runners," which consisted of a couple of millstones, united by a horizontal axis passing through two stones, and attached in the middle to a vertical axis. The stones were commonly lined, and had edges of cast iron, and the rotation was effected by a spindle. Large runners of this kind were exhibited at the recent Exhibition at Paris, and he might remark that this and all similar kinds of apparatus were only applicable where the material was to be reduced to powder. One of the greatest improvements in this department of mining was the introduction in the beginning of this century of a crusher or grinder, in which the whole of the orey material was reduced between cylinders rotating towards each other. This machine was introduced first in the neighbourhood of Tavistock, from whence it spread into Cornwall and Wales, but it was not until some time afterwards that the continental miners, who had been in advance of us in many matters connected with mining, borrowed the idea. The apparatus in question was upon the same principle as the coffee-mill, and was not unlike the machine, upon a larger scale, for reducing coal and putting it through the washing process. There were a few points to be noted with regard to the rollers connected with these machines. Generally speaking, they were rather short compared with the diameter, and it was necessary that everything about the apparatus should be of the greatest strength. The rolls, as generally made at the present time, were from 18 in. to 3 ft. in diameter. In the North of England it was customary to employ three pairs of rolls, the first pair being channelled, and the material having been broken up by them to a certain size, it slid down to the second pair, where it was further reduced in size, and it was afterwards passed on to a third pair, which crushed any portion of the material which had not been ground sufficiently fine. In the West of England it was more usual to have only one pair of rollers, and where they were well managed they worked better than the triple rollers; but it might be objected that more manual labour was required for breaking up the material to a uniform size where only one pair of rollers was used, so that it might be well to have a small pair for further reducing the material which had not been sufficiently ground. The rollers should be made of the best or No. 3 cast iron, and it had been sought to render them still better by employing chilled iron, but this not having been found to answer well in practice the ordinary iron was preferred, but of the very best quality. Still, such was the friction of the rollers that after a few weeks wear they would present such a worn and uneven appearance that large pieces might be passed through them without coming into contact with them. In some instances the machine was so constructed that the shell could be renewed when the rolls became very much worn, and for this purpose it was usual to keep several shells constantly in readiness on the works, so that no delay might occur. At some mines each pair of rolls were made of the same length and diameter, but at others it was preferred to make them of different lengths. Thus, at the Devon Consols Mine, where, perhaps, a larger quantity of "dradge" ore was crushed than at any other mine in the world, the first pair of rolls were 34 in. diameter and 22 in. long, while the second were 24 in. long. It was asserted that by making the rolls of these proportions the surfaces were kept in better condition than if they were made of the same length. The crusher in operation at the mine he alluded to was capable of crushing 15 tons of the better class of ores per hour; but if the ores were of the poorer description the quantity would be much less, as the proportion of pyrites would be greater. He also instanced the case of a crusher of which the rolls were 30 in. diameter, and only 17 in. long, and the other 24 in. This machine was capable of crushing 20 tons of a certain class of ore per hour. This amount of work, however, was not by any means that ordinarily performed by these machines, but they might expect an efficient machine to grind down from 20 to 30 tons in a day of ten hours. Other questions which arose in reference to these crushers were at what rate they should be made to revolve, and ought the materials to be put in dry or wet. These were very important questions, but no *à priori* answer could be given to them. It had been settled that the circumference of the rolls should not revolve at a less speed than 30 ft., nor more than 80 ft., per minute, the average being about 48 ft. If they revolved at too low a speed a proper amount of work would not be obtained from them, and if the speed were too great the material would pass through without being properly crushed. Water-power had frequently been employed to turn the rolls, the latter being connected with water-wheels, intermediate gearing having to be employed to secure a proper speed. With reference to the introduction of water, it could not be denied that in some cases this was a decided advantage, as it facilitated the grinding very much. With some materials, however, it would not be desirable to introduce water—such as argillaceous ores, which require washing before submitting to any treatment whatever, and in these instances it would be found that if they put them into the hopper they would be pounded into a tenacious mass, which would only pass through the machine with great difficulty. But if the ores were associated with fluor-spar, water might be advantageously mixed with them, as it would keep the surface of the rolls cool, and would also assist in carrying the material through the different parts of the machine. The latter, indeed, was a great point in regard to the economy of the crushing process, and if the material to be passed through were suitable, they should enter at one point, and, carrying the ores along with it, pass out at a further point.

Whatever the modes of trituration adopted may be, they must be carried out with a great deal of care and minute attention when the ores of gold, silver, and tin are concerned. These metals are often disseminated through the halvan in very small proportions. Gold ore is generally reduced to grains of a comparatively large size, but frequently in the case of silver it is necessary to reduce it to a very fine powder for the purpose of amalgamation. The ores of silver, with the exception of the argentiferous galenas, cannot be treated mechanically, as the metal is so finely disseminated through the mass in the form of brittle sulphides, which, on being subjected to the action of water, would not fall to the bottom, but be floated away. Berthier, a French author, has shown that even, with the most careful processes of washing, half the amount of silver originally present in many ores, and particularly those of Mexico, would be lost. This fact was known and recognised 300 years ago in the silver mines of South America, and a miner named Medina, who lived in the neighbourhood of Real del Monte, discovered that by the admixture of quicksilver the affinity of silver for that metal enabled him to obtain from the mass a much larger proportion of silver. This was called the Patio process, and the amalgams usually employed are common salt, mercury, sulphate of copper, and a substance called "magistral," which is manufactured from copper pyrites. The grinding machinery for silver ores in South America, therefore, reduces them to a fine powder. The Spanish "arrastre" is now a good deal used in this country, and particularly in the Potteries, for grinding flints. It is a large trough, in which circular blocks of stone are drawn round by horse power, or by mules in Spain. The flooring is generally made of the hardest chert that can be procured, and the blocks that are driven round are of the same material. Another contrivance is the Chilian mill, which is not unlike the mill in which mortar is worked here, and is well suited for crushing tinstuff. All the contrivances for crushing which have been introduced have not, however, superseded the old-fashioned "stamps" which have stood the test of centuries. In some mines in Cornwall the stamps are on so large a scale that they often get through 30,000 tons in a year. Stamps are heavy beams, shod with iron or steel. Each beam has affixed to it a projecting shoulder, arranged so as to meet a similar projection on a revolving cylinder, the latter lifting the former, and raising it so as to give a fall varying from 8 in. to 1 ft. In the majority of the Cornish mines the lifters are of iron, but wood is elsewhere quite as frequently used. The weight of the heads varies from 5 to 8 cwts., and they are now almost invariably made of the hardest cast iron. Where the machinery is of a good character 50 or 60 blows per minute are given, and the noise made by the work is deafening.

The next process after the material leaves the stamps or the crushers is to separate the different substances which form the whole mass one from another. This is done either by ties or troughs, in which by the aid of water the different specific gravities of the minerals naturally separates them, or by buddling or jigging apparatus. The ties or troughs follow each other in such a way as to obtain a deposit in each, until at last the stream comes almost to a standstill, and goes into the last tie, which is called the slime-pit. It many cases the slime-pit is dispensed with, but that is most unwise, as in the case of tin or silver there was invariably a certain proportion of metal in the slime. The arrangement and size of the ties varies very greatly, according to the nature of the material, sometimes being only 6 ft. or 8 ft. long, and at others 12 ft., or even 18 ft. [The lecturer illustrated these and other apparatus by a copious exhibition of models from the Museum—Hunt's buddling apparatus, different sorts of jigging sieves and hutches, rotary griddles or sieves, percussion tables (Fr. *table a secousses*), mentioning that of Rittinger and his continuous jigging-machine with great approval.]

Mr. SMYTH concluded the course of lectures in the following terms:—The subject of dressing ores is one which, if gone throughly into, would overwhelm you with little particulars, of which you would not now see the object or value. My object, therefore, has been to show you simply what the nature of the processes are, and to impress upon you the fact that they may be performed so ineffectively, or so expensively, as to render nugatory all the skill, labour, and capital expended in getting the ores from the depths of the earth. You will see (as I stated at the outset) that as the aid of science is continually necessary in all the other works of mining, so especially is that aid required in dressing, and particularly the sciences of mechanics and chemistry. Indeed, the chemical-amalgamations which the precious metals often require to free them from their associated minerals is almost a science of itself. Those of you who pursue the study of mining further will, I hope, be induced by what I have said to carry your observations at the earliest moment into the practical working of mines. It is only by practical experience in the mine that you can learn how to apply the theoretical and scientific knowledge you have acquired here. If you are able to use the hammer and the pick yourselves you will be also able to judge truly the difficulties to be overcome in breaking ground, and the relative merits of the workmen you employ or have to supervise. If I should have the pleasure in the course of the summer of meeting any of you in our mining districts, or in those of the Continent, I shall have great pleasure in giving you introductions to those mines where the work is best carried on, and in which you will find most to admire and profit by. (Loud cheers.)

THE MIDLAND INSTITUTE OF MINING ENGINEERS.

The first meeting of this association was held on Tuesday, at the rooms in Barnsley formerly occupied by the South Yorkshire Viewers, and was largely attended. Amongst those present were Mr. J. T. Woodhouse, Derby; Mr. T. W. Embleton (President); Mr. P. Cooper, The Holmes Colliery; Mr. W. Jeffcock, Sheffield; Mr. Wilks, Glass Houghton; Mr. Lupton, Chesterfield; Mr. Miller, Strafford Main; Mr. Minto, Mr. J. Beaumont, and Mr. Barker, the Oaks Colliery; Mr. Hodgson, Normanton; Mr. Embleton, jun., Methley; Mr. Warburton, Staveley Colliery, Wakefield; Mr. Bradley, Monk Britton, Mr. Willis, Drighlington; Mr. Kell, Barnsley; Mr. Keightley, New Hall, Normanton; Mr. Wilson, Darfield Main; Mr. W. Rowley, Leeds; Mr. Green, Mr. Woolley, Mr. Mammatt (secretary), &c. After the transaction of some preliminary business, the President, Mr. T. W. Embleton, delivered the inaugural address, in which he reviewed the various works connected with mining operations, including underground transit, ventilation of collieries, and the winning and working of them; the prevention of accidents by explosions and falls of roof, and urged the necessity for a strict observance of rules. He also spoke of the advancement of the science of mining and engineering, showing that it must keep pace with similar sciences. At the conclusion, a cordial vote of thanks to Mr. Embleton for the paper was proposed by Mr. Miller, and seconded by Mr. Woodhouse. In the evening a considerable number of the members dined together at the King's Head Hotel. During the evening speeches were made by the President, Mr. Woodhouse, Mr. P. Cooper, Mr. Jeffcock, and others.

SOUTH MIDLAND INSTITUTE OF MINING, CIVIL, AND MECHANICAL ENGINEERS.

The monthly meeting of this society, of which Prof. Beckett is President and Lord Littleton Vice-President, was held in the lecture-room of the School of Art, Wolverhampton, on Tuesday,

Mr. S. BOWKLEY, F.G.S., in the chair.

It was announced that since the inaugural meeting, held a month ago, the Duke of Sutherland, Earl Granville, the Earl of Lichfield (Lord-Lieutenant of the County), the Earl of Dartmouth, Lord Lyttelton (Lord-Lieutenant of Worcestershire), and Viscount Hill (Lord-Lieutenant of Shropshire) had consented to become patrons of the Institute; also that the following Mines' Inspectors (in addition to Mr. Baker, for this district, and Mr. Wynne, for North Staffordshire and Shropshire) were in the list of honorary members:—Mr. T. Evans, Mr. Dickinson, Mr. Higson, Mr. Alexander, Mr. Sothern, Mr. Wardell, Mr. Wales, and Mr. R. Moore. Mr. Lionel Brough and Mr. C. Moore are expected to join. Prof. Ramsay, F.R.G.S., has also become an honorary member: 15 new ordinary members, including Mr. E. F. Bateman, F.G.S., C.E., were added to the list, making the total number at the present time 64.

The Chairman, in a few complimentary remarks, introduced Mr. J. Randall, F.G.S., of Madeley, who proceeded to read his paper, as previously announced, "On the Evidence of Denudation, as furnished in and around the Shropshire Coal Field." Mr. Randall introduced his subject by remarking that, in a general sense, the evidence of denudation was universal, and that the present outline of the Midland Counties was but the sculptured form the agents of denudation had given it. There is no question but that great masses of strata, now widely separated, were once united, and that thousands of vertical feet, extending over hundreds of square miles, have been displaced by one means or another. Evidence of such displacement, and of the removal of important mineral sheets presents itself in, above, around, and beneath the coal measures of the county of Shropshire, and more pointedly with what is known as the Coalbrookdale Coal Field. In one sense, however, such evidence is almost universal, and it requires but little geological knowledge to perceive that for each portion of the present structure of the earth an equal amount of solid matter was removed from some other place. As some stone building, some brick wall, or pit mound represents the abstraction of so much material from some open quarry or underground mine, so rocks, which here and there crop up around us, represent the removal of so much material from somewhere else. In the former place the tools employed are the same as have been in use since mining began; in the other the agencies, equally simple, are such as have been in operation from the beginning until now, as they are rivers, currents, and waves of the sea. The action may be slow, yet it requires little faith to believe that it was by them that mountains have oftentimes been removed, and cast into the sea. And there is no reason that we know of why these agencies should have been more powerful, or why either should have acted with greater intensity, or have occupied a less period in accomplishing their task formerly than at present. We still see the atmosphere at work upon the hills reducing hard rocks; we see rivers deepening and widening their valleys, and the waves encroaching upon the coast; and we see everywhere in the present outline of the country evidence of their operation. It is not often we see the effects they have produced upon rocks underground; it is rarely, even in mines, that more than a very limited space is exposed at a time, but from comparing experiences now and then presented it is not difficult to arrive at sound conclusions. It sometimes happens that in examining these rocks great gaps in the order of succession occur, and that one sets of rocks complete in one case is incomplete in another. It is like examining a building which, or the greater portion of which, may have been long covered up, and in which, although the upper story may not be much unlike others of the present day, yet on excavating you pass from one style to another, and find a complete patchwork of opposite kinds of architecture without any indication of transition period. Fortunately, in Shropshire, we have opportunities of examining the old structure Nature has razed even to its foundations, on from the lias, at least to the Llandeilo flags, and thence to the bottom rocks of the Longmynds. But to the geologist who has once made himself acquainted with the alphabet of the science it is of little consequence whether he sees the actual series of rocks as they are found in one place or not. The remains of the fauna or flora of the period will show to him whether each link of the chain is there, or whether some are missing.

In Shropshire and in South Staffordshire not only are some of the important links of the chain missing, but some of those remaining have been greatly damaged. Members of the carboniferous series, and others of the Silurian, now occur in direct contact, although widely separated in point of time. Indeed, there appears good reasons for supposing that, widely as our coal fields are now separated, the older and more important one of Coalbrookdale was once united with that of South Staffordshire, with the Forest of Dean, and with the South Wales Coal fields, if not with those of Flintshire and North Staffordshire, and that they have been isolated by causes requiring long periods for their operation.

The paper then went on to show the evidence of denudation at successive periods—first, in the foundation rocks on which the coal measures rested; second, in the older coal measures themselves; third, in the younger group, which were only to be found in isolated patches many miles apart. He exhibited specimens of the denuded seams, first in the Top coal, and secondly in the Clod coal, some 60 yards lower down, both of which he said were now being worked up to the Great Eastern Boundary Fault, in the Madeley Wood Company's pits, near Madeley and Kemberton. These coals had evidently been penetrated by the water of the estuary, and had still adhering to them the sediment contained in the water, which deteriorated and partially destroyed them.

Taking the distances at which one after the other of the entire series disappeared, as given by Mr. Marcus Scott in his paper, and found at points still more south than he had given it, Mr. Randall said a coast line was indicated varying in its slope from 1 in 40 to 1 in 11, the inclination to the east being greatest as the trough of the estuary was approached. He next directed attention to the fact that not only had the old but even the younger coal measures suffered by denudation to the south, but that the older rocks themselves had been planed down, and gave it as his opinion that a very poor prospect existed of finding workable coals between Madeley and South Staffordshire on the south; he also instanced cases in which costly but futile attempts had been made in that direction to discover members of the older series beneath the upper and younger

ones, as in the case of Mr. T. Duppa, who spent upwards of 20,000*l.*, ruined himself, and died broken-hearted.

A vote of thanks followed the conclusion of the paper. Mr. Randall invited discussion, but the Chairman remarked that the paper opened up so wide a field, and embraced questions so important in themselves, that he would suggest that a meeting should be held for that purpose, when he trusted that the author of the paper just read would be able to attend. He must say for himself that he did not concur with some of the views they had heard, and he believed that none would be more ready to hear the reasons assigned than Mr. Randall himself.

Mr. TILDESLEY then read an able paper "On Tildesley and Bird's Smoke-Consuming Apparatus," which was illustrated by some admirably executed drawings, and received a cordial vote of thanks from the meeting.

SOUTH STAFFORDSHIRE INSTITUTE OF MINING ENGINEERS.

This society held its monthly meeting at Dudley, on Monday, Mr. DAVID PEACOCK, the President, in the chair. The hon. secretary (Mr. Henry Johnson) introduced the Rev. H. Sandford, who attended the meeting for the purpose of eliciting from the members of the mining profession their opinion upon the education clause intended to be introduced into the new Mines Regulation Act. The reverend gentleman, who has devoted so much attention to the cause of education amongst the lower classes, explained at some length the present state of the law affecting the education of the young miners, and regretted to have to express his conviction that the law had been up to the present time inoperative, in consequence of the masters refusing to employ them at that age where the law became operative. So that, as the law now stands, hundreds of boys were deprived of both labour and education, as their parents had not the means to feed, clothe, and pay for their education. The rev. gentleman, after explaining the law in practice on the Continent relating to education, wished for an expression of opinion from the members of the Institute. A long discussion then ensued, in which seven or eight of the members present took part, the general result of such expression of opinion being that it was a question beset with such numerous and insurmountable difficulties that they feared it would be a long time before a satisfactory mode of educating the miners would be accomplished. All of them considered the present plan to be productive of harm rather than good, for instead of being educated the boys were simply learning idleness and crime, and that both bad qualities would become deeply rooted in them through life. Mr. Sandford was glad he had elicited an opinion from so practical a body of mine managers, and retired.

Seventeen new ordinary members were elected, eight more proposed, and seven out of the twelve Government Inspectors of Mines were elected honorary members.

BOILER EXPLOSIONS—ANTI-INCRUSTATION COMPOSITIONS.—At the Manchester Steam Users' Association meeting, on Tuesday, Mr. L. E. Fletcher, chief engineer, referring to one explosion, said the owner of the boiler had adopted a new composition for the prevention of incrustation for six or seven months before the explosion. This composition proved most efficacious for preventing incrustation. It removed the hard cakes adhering to the plates and reduced them to powder; so that when the men entered the boilers for cleaning, instead of finding them coated as before with a tenacious scale requiring hammer and chisel to remove, they found several bucketfuls of flour or dust, which was readily washed out. There must evidently have been a large quantity of this fine floury deposit accumulated in the boilers, and floating about in the water when they were at work. The fine floury deposit appears to interfere with that intimate contact between the water and the plates which is necessary to prevent over-heating, while it may be that, from the thickened water, the globules of steam cannot freely escape, and, thus caged within it, linger longer in contact with the plates over the fire than they should do, and thus form a film between the iron and the water, in consequence of which the heat is not carried off rapidly enough, and over-heating ensues. It is not intended by this that they are made red-hot, but that they are heated sufficiently to so increase their ductility as to lead to the undue compression and the consequent deflection of the over-heated parts. The explosion is, therefore, attributed to over-heating of the furnace crowns, though when covered with an ample supply of water, consequent on the accumulation within the boiler of a large amount of fine floury deposit, caused by the use of an arsenical composition for preventing incrustation, coupled with the suicidal practice of neglecting to open the blow-out taps. This is the first explosion which has ever occurred to a boiler guaranteed by this association; and it will be impossible, without the hearty co-operation of the members, to prevent such, without imposing restrictions upon them with regard to the treatment of their boilers, which the association has at all times been desirous to avoid. But this opportunity may be taken of strongly urging upon the members the advice which has repeatedly been given personally on previous occasions—that they should not experiment on their boilers with anti-incrustation compositions. They will find it a safe, and in the majority of instances a very efficacious, plan to feed the boilers with 2 or 3 lbs. of good soda-ash daily; the soda not being introduced in heavy charges through the man-hole at cleansing times, but along with the feed, so that the boilers may be constantly fed with weak soda-water; while the blow-out taps, both at the bottom of the boiler and surface of the water, should be regularly used. There is a composition now strongly advocated which acts rather mechanically than chemically, by forming a thin film of varnish upon the plates, and thus preventing the adherence of the scale. With some waters this has its dangers; the film or coat of varnish may protect the plate from the water as well as from the incrustation, and thus lead to over-heating, and two cases of injury have recently been met with which have arisen from this cause.

A "Colliery Proprietor" writes—"In these days so rife with accidents, I feel no diffidence in calling the attention of your readers to an instrument recently invented whereby boiler explosions, to a great extent, may be avoided. I allude to the steam-pressure guage lately patented by Messrs. King and Co., of Newcastle, which, by the ingenious adaptation of mercury and glycerine, arranged in a series of tubes, renders its accuracy perfect, without the slightest liability to derangement by corrosion, temperature, or other causes which so frequently affect metal guages. 'A word to the wise is sufficient.'"

ACCIDENTS IN COAL MINES.

A series of lectures on the nature and properties of atmospheric air, the causes of colliery explosions, &c., by Mr. JAMES WILSON, viewer, of Darfield Main Colliery, near Barnsley, has just been issued, and in a plain and practical manner deals with the question of the preventability of accidents in coal mines through explosions of gas. Much has been made of the recklessness of the miners as a body, and of which there is little doubt, and the public are often startled on reading the accounts of some terribly fatal catastrophe at a colliery to find it stated that a damaged lamp was found lying close to one of the bodies, or, as at Ferndale, that a tobacco-pipe was found close to some of the deceased. The inference, of course, is that a naked light, either by the damaging of the lamp, or the striking of a match to set fire to the tobacco, has caused the gas to ignite, and led to the fatal consequences which ensued. That such has actually been the case with regard to some accidents there can be very little doubt. The question, then, naturally arises—Should a man be allowed to work in a place so charged with gas that an accident to a lamp should not only imperil his own life, but that of hundreds of others; or that even the striking of a match by an ignorant man should lead to similar results? On this point the views of Mr. WILSON, a practical viewer, having some hundreds of men under his charge, are worthy of consideration. He says:—

"Colliery accidents will occur, and it will be difficult to entirely prevent them; but I do think the present annual sacrifice of human life is not necessary, with our present knowledge and long experience in working our pits. I, therefore, do think that a very large proportion of our present accidents are preventable. I see no reason why a gas whose nature is perfectly understood, and whose presence is easily detected, should be allowed to accumulate until some chance accident, or a careless workmen, is the immediate cause of converting it into a seething flame of fire, and then into a dense fog of life-destroying poison. Science and practical experience have led to many inventions, mental improvement and strict discipline have made the workmen more cautious, careful, and obedient—yet all the boasted knowledge of Nature's laws have not produced a tithe of the improvement it ought to have done; but let us trust that the lesson from recent colliery accidents will lead to an earnest protest against their recurrence. Dangers which are manifestly apparent ought to be at once and forever abolished. So long as such dangers exist the public are justified in demanding more protection for the colliers—so long as explosions result from disarranged ventilation—such a state of things ought not to exist. It is a disgrace and a crime to tamper with men's lives when danger is known to exist and the most ordinary precautions neglected. Such accidents as explosions of carburetted hydrogen will occur; but, in my opinion, they may be very much diminished. Some gentlemen recommend ventilating furnaces; others forcing air into the downcast shaft; others dividing the men and boys into day and night shifts, so that there may be fewer men and boys in the pit at one time; others recommend certain safety-lamps as the best; others the laying down of pipes to convey the air into the different working places. There are others, also, who suggest the putting down of more pit-shafts, and others the piping the gas out of the gobs. I ask—What about the future? Are those things to be allowed to go on? Are accidents and explosions, which for the most part are preventable, to be permitted, to the destruction of hundreds of human beings, and to the sorrowing and suffering of thousands."

Mr. WILSON then recommends—seeing that it would be inconvenient and expensive to have the shafts as large as could be wished—the increasing the size of the airways, so as to secure larger quantities of air for the use of pits, so that the current could not be throttled. He also holds that there may be plenty of air in a pit, and yet by bad arrangement in the conducting of it it may be rendered comparatively useless in preventing explosions. To guard against these defects, he says:—

"It is necessary that the person having charge of the ventilation should possess some knowledge of the science and laws of pneumatics, so that he may be able to discern and adopt the best and easiest mode of arranging, dividing, and conducting the currents—for, owing to a lack of this kind of knowledge, a very simple circumstance has been known to make all the difference between good and bad ventilation. For instance, a mere disregard of the fact that air always travels easiest and the gas always escapes best when the intake is to the dip and the return to the rise than it does in an opposite course, and always requires the return air-courses to be larger than those of the intake—this is sometimes the origin of fearful explosions."

Mr. WILSON considers that if the present rules are carried out explosions would not take place, or only in very exceptional cases, such as by a blower of gas. Still, the first rule, if fully attended to, cannot but prevent explosions, seeing that it requires that an adequate amount of ventilation shall be constantly produced in coal mines to dilute and render harmless noxious gases to such an extent that the working places, levels, &c., "shall under ordinary circumstances be in a fit state for working and passing therein."

With regard to the systems adopted in different districts for getting coal tending to lead to explosions, Mr. WILSON says:—

"It is a fact that the mode of working at one colliery will not suit another. You will find a bad top at one, and a good top at the other; you will have many faults at the one, and none at the other. Then we have a pit with a heavy rise, another with none. In the working of long wall it is a common thing to set off the banks at the lowest level. Under such circumstances, it is no uncommon thing to find large accumulations of fire-damp lodged in the fallen goaf close to the workmen, even where a good current of air is passing along the face. The working faces advance slowly, accompanied by a slight falling of the roof to no great height in the goaves, leaving large spaces more or less filled with fire-damp, until the whole weight of strata settles down, and forces out the fire-damp on to the workmen at the coal face. This awful state of things is not unusual under such circumstances, and will continue to be so long as working on the rises of coal and strata goes on, as gas naturally ascends and accumulates close to the men—so that in all cases you have all the men working at the top or high part of the gob, the gas makes its way out of the seam, and mixes with the air."

From Mr. WILSON's long experience, and the fact that the colliery under his charge—although the seam worked is of the usual fiery character which prevails in South Yorkshire—has so far been fortunately free from those serious disasters which have prevailed at the neighbouring collieries, his views are worthy of attention and consideration, as are those of all persons who contribute in any way to the means for the prevention of accidents in our coal mines.

RECENT IMPROVEMENTS IN THE STEAM-ENGINE.

The works upon the Steam-Engine, issued from time to time from the pen of Mr. John Bourne, are so well and so favourably known to practical engineering students that each new volume is sure to meet a favourable reception. That just issued* originally appeared as a supplement to the author's Catechism of the Steam-Engine, but is now published in an enlarged and amended form as a separate work. In the new volume Mr. Bourne has inserted notices and drawings of some of the most remarkable engines exhibited at Paris in 1867, adding much to the value of the information by appending his own comments upon the several machines. He observes that in steam-engines the tendency is now toward higher piston speeds and higher pressures of steam; and high piston speeds require superior workmanship, especially in the bearings, to prevent heating; and the momentum also of the reciprocating parts should be balanced by counterweights. Unless the bearings of engines be very accurately formed, the oil is forced out of the protuberant or touching parts, and the surfaces heat since the effective surface is, in fact, measurable by the area of the real points of contact; whereas, when the rubbing surfaces are very true the oil is spread over them in a thin film, and metallic contact is prevented. In many steam vessels a pressure of steam of 60 lbs. and upwards is now employed. These engines are fitted with surface condensers, and the steam after acting by high pressure in one cylinder is dismissed into the other, where it acts as low pressure steam. The consumption of coal is reduced by this arrangement to about 2 lbs. per actual horse-power per hour.

Mr. Bourne repeats his opinion that the steam-engine has now nearly fulfilled its destiny, and is on the eve of supercession by other motors; and he states, moreover, that the task he now proposes to himself is not merely to show that a better engine than the present steam-engine can be made, but how it can be made; continuing that it is not to be supposed that he should have spoken with the confidence he has done of the early supercession of the steam-engine if he had not seen his way in this important work. The relative merits of the various forms of boilers and engines are pointed out, and as Mr. Bourne gives his reasons for the opinions he expresses their value can be readily judged of by practical men. He maintains that the Giffard's injector is objectionable as a main feeding instrument, remarking that the advantage of the apparatus is that it gets rid of the feed-pump, with its valves, which have been a source of constant trouble in engines working at a high speed. But unless it can be so modified as to send the feed-water into the boiler at the boiling point to which it will be heated by the waste heat of the engine, he does not see how this injector can be retained as a main feeding instrument, though it will always be valuable as an auxiliary. He condemns the Corliss engine, by remarking that it is not pretended that it is able to work with greater economy than ordinary engines, while the complications of its valve gear are manifest and enormous. There are four separate valves or cocks for the admission and emission of the steam, and the gear is governed by the aid of air cushions, springs, and other rattle-traps, which by their complexity throw the old hand-gear into the shade. Apart from these disfigurements, however, the general plan of the engine is not so good as that of some other engines now in common use, But, with these additions, the engine may be pronounced to be as bad a one as perverted ingenuity could easily have constructed. The American example of this engine shown at Paris, in 1867, was of admirable workmanship, and was radiant with silver, in which the cylinder was enveloped. But these aids to acceptation were incapable of concealing from competent observers the inherent vices of the design, which appears to reckon complication as a merit, and which seeks to achieve no advantage in economy, by a great multiplication of parts.

The work, as a whole, is fully worthy of the commendation which has already been bestowed upon it. It affords an enormous amount of very valuable information, given in a style which is calculated to induce the student well to consider what he reads, and thus to profit to the utmost by his reading.

* "Recent Improvements in the Steam-Engine in its Various Applications," &c. By JOHN BOURNE, C.E. London: Longmans, Green, and Co.

PRACTICAL ENGINEERING—OBLIQUE ARCHES.

The importance of works the object of which is to enable the practical man to proceed with mathematical accuracy in his business, without requiring to undertake the labour of studying pure mathematics, is more extensively acknowledged every day; whilst the continually increasing attention paid to technical knowledge by business men enables strictly scientific men to afford them the necessary theoretical aid with far greater facility than formerly. A very valuable treatise of the technical science class* has just been issued by Mr. DONALDSON, and will, doubtless, find a large number of patrons. The object of the author has been to arrive at a series of formulae which would give the data necessary for the construction of oblique arches, without having recourse to any developments on a large scale, or which require skill in draughtsmanship. He commences by explaining and demonstrating the properties of screw surfaces, and then proceeds to investigate the stability of oblique bridges, basing his investigations upon the assumptions—firstly, that the material can resist any pressure that can be put upon it; and, secondly, that for perfect security no force of shearing must be exerted upon any of the voussoirs. He explains that the forces acting on a voussoir are its own weight, a portion of the weight passing over the bridge, and the pressures on its beds. No force is exerted on the ends of a voussoir; in oblique bridges it is kept in its place by the friction on the beds. If there were no backing these forces must be in equilibrium; this is never the case where the live load is variable; they must, therefore, have a definite resultant. We may resolve these pressures in three directions—vertical, parallel to the axis, and perpendicular to these two; the resultant of the vertical components will be equal and opposite to the weight of the voussoir and the weight upon it, and in order that the horizontal components may satisfy the condition for perfect safety their resultants must fall within the springing nearest to the bed to which they refer, so as to meet the material with which the bridge is backed up; also since the pressures between the voussoir beds are mutual the horizontal resultant of each pair must pass within each springing. He explains that the pressure at any point of a voussoir bed will act in the direction of a normal to the surface at that point, and will, therefore, lie in the normal plane to the screw line passing through that point, and will also be perpendicular to the revolving radius; and, therefore, its line of direction will be the line of intersection of the above normal plane, and a plane through that point perpendicular to the radius—the pressure at every point along this radius may be assumed to be the same. Having disposed of the question of the stability of oblique arches, Mr. Donaldson treats of the formation of templates. All the formulae previously proved are collected together and their use explained, by working out the details of a bridge, an angle of 45° being chosen, because an instance in which the skew is very great gives the best illustration of the errors introduced by the approximate methods used. Throughout the book Mr. Donaldson displays not only an intimate knowledge of the subject on which he writes but also a great ability in imparting that knowledge to others. The work is strictly mathematical, but a knowledge of logarithms only, and this may be acquired in five minutes by those who do not already possess it, will suffice for the practical application of the formulae.

* "A Treatise on the Art of Constructing Oblique Arches with Spiral Courses." By Wm. DONALDSON, M.A. Cant., Assoc. Inst. C.E. London: E. and F. N. Spon, Charing-cross.

ARTIFICIAL FUEL.—For the utilisation of small coal and slack, Messrs. HOSKOLD and WHEELER, of Cinderford, propose to reduce coal dust, lime-coal, slack, culm, or other bituminous substance, to powder, adding coal shale clay during the grinding, and to incorporate the mixture with powdered resin, asphalt, or compact natural bitumen, or vegetable glue, formed by boiling 5 lbs. of rice and 5 lbs. of Indian corn-meal with 50 gallons of water.

MANUFACTURE OF COKE.—Mr. ALFRED HOMFRAY, of Witley Lodge, Halesowen, has specified his invention for improvements in the manufacture of coke, and in machinery or apparatus to be employed in the said manufacture, to have for its object principally to make coke from small coal or slack, but may also be applied to the manufacture of coke from lumps of coal. In making coke according to this invention he takes slack or coal broken into slack, and consolidates the said slack into blocks by driving it little by little into moulds or rings of iron, fire-clay, or other strong material, the slack being by preference wetted with water during the consolidating process. The consolidation of the slack in the said moulds or rings is effected by the percussive or stamping machinery hereinafter described. The moulds containing the consolidated blocks are heated in a furnace, and the coal is thereby converted into coke. He prefers to pile the moulds filled with consolidated coke upon one another, so as to prevent as far as possible the combustion of the coal during the coking process; or the blocks of consolidated coal may be coked without being protected by their moulds or rings. Although any ordinary furnaces may be employed for the purpose of coking the blocks of consolidated coal, yet Mr. Homfray prefers to effect the coking in a furnace or apparatus constructed in the following manner:—A chamber heated by a furnace is provided with a series of tubes passing across it from top to bottom or from side to side; the blocks of consolidated coal, either alone or contained in the moulds or rings, are introduced into these tubes at one end and slowly passed to the other; they thereby become coked, the volatile matter driven off from the coal during the coking process escaping through holes in the said tubes into the said chamber, and by its combustion rendering only a small fire necessary on the furnace grate. The machinery or apparatus by which the consolidation of the slack is effected consists of an anvil block and a ram or hammer worked by a steam or other hammer or press. The mould or ring is placed on the anvil block and slack supplied thereto, the ram of the hammer or press being so worked as to produce a series of blows similar to those employed by the miner in the process of "tamping." The slack is thereby consolidated into a dense coherent block of coal, which is coked in the manner herein before described. Although he prefers to add a little water to the slack during the consolidating process, yet he does not limit himself thereto. Pitch or tar, or other bituminous matter, may be used instead of water, but their use is not necessary.

FOREIGN MINING AND METALLURGY.

During the first four months of this year the total imports of pig into France showed an increase of 11,188 tons, as compared with the corresponding period of 1868. The imports of iron and plates into France in the first four months of this year showed, on the contrary, a diminution of 2553 tons. These results will be more fully indicated on an examination of the annexed figures:—

	Pig.			Iron and plates.	
	1869.		1868.	1869.	1868.
Imported free of duty..Tons	46,239	....	30,259	13,276	17,329
" for shipbuilding.....	734	....	272	3,137	1,804
" with payment of duty	1,330	....	6,584	851	684
Total	48,303	....	37,115	17,264	19,817

Annexed are the quantities of minerals imported into France in the first four months of 1869 and 1868:—

Source of supply.	1869.		1868.
Belgium .....Tons	33,926	Tons	22,392
German Association	20,055		24,881
Spain	16,423		14,789
Kingdom of Italy	15,763		12,058
Switzerland	216		1,283
Algeria	69,238		44,096
Other countries	132		43
Total	155,753		119,542

The Eastern of France Railway Company has ordered 30,000 tons of iron rails from the house of Wendel, at the rate of 7*l.* 14s. per ton; and six iron bridges, from MM. Leture and Baudet, at 16*l.* 16s. per ton for the ironwork, and 10*l.* per ton for the castings. The Western of France Railway Company has ordered 1000 tons of Martin steel rails from Messrs. Schneider and Co., at 12*l.* 10s. 11d. per ton; 2000 tons of chairs, from the houses of Voruz aîné and V. Doré, at 5*l.* 6s. 5d.; 300 tons of fish-plates, at 8*l.* 14s. 10d. per ton; and 150 tons of steel ditto, at 10*l.* per ton. The state of the French metallurgical markets has not presented any material variation. In the Moselle refining pig is quoted at 2*l.* 16s. per ton; No. 1 pig, for re-casting, is in demand at 3*l.* 16s. per ton. Iron has been in greater demand at St. Dizier; prices have displayed no material change. Rough pig has not given rise to any important transaction at St. Dizier, but some other descriptions have been a good deal sought after. A German order for a great syphon has been received at the Bussy Works; the order is one of considerable importance, the diameter of the pipes being no less than 6 ft. 8 in. The works of the Meurthe and the Moselle are rather more favoured than those of the Haute Marne, in consequence of the regular demand which they experience, and the firmness in prices which the abundance of work necessarily involves. The Frouard furnace, which produced black pig for second fusion, has just been lighted for the production of refining pig. The Heming Works have been rented by M. Lemonnier. These works comprise two furnaces of average dimensions, capable of producing 10 tons each; one is still worked with charcoal, on the account of M. Salin, who is burning up his old stores of combustible; the other has been handed over to M. Lemonnier, and produces coke-made pig. The Moulaine Furnaces, it is understood, are to be immediately offered for sale. A sale has been attempted recently of the St. Charles Forges, situated in the centre of Charleville, in the Ardennes; the reserve price of 7600*l.* was, however, not attained. A fresh attempt to effect a sale of the works will, it is understood, be shortly made. There is scarcely anything fresh to report with regard to the Paris metallurgical market, which remains in a favourable state.

The exports of coal and coke from Belgium in the first three months of this year show an increase as compared with the two preceding years. The comparative statistics of the first quarters of the last three years present the annexed results as regards coal:—

Direction of export.	1869.	1868.	1867.
Russia .....Tons	350	—	—
Zollverein	4,062	2,760	1,155
Low Countries	23,259	21,570	20,974
France	826,176	790,047	781,292
Other countries	61	804	1,522
Total	853,908	815,181	804,941

With respect to coke, the exports of the first quarters of the last three years stand thus:—

	1869.	1868.	1867.
Zollverein .....Tons	55,045	39,442	20,450
Low Countries.....	81	52	41
France	91,887	87,418	124,164
Other countries	389	—	—
Total	147,402	126,912	144,655

The condition of the Belgian coal markets has not presented any very material variation; prices remain unchanged, although the demand is tolerably well sustained, especially for coal for industrial purposes. The exports of rough pig from Belgium in the first three months of this year amounted to 5550 tons, against 2656 tons in the corresponding period of 1868, and 2379 tons in the corresponding period of 1867. The important augmentation indicated by these figures in favour of the first quarter of this year arose specially in the exports to the Zollverein, which amounted in the first quarter of this year to 3264 tons, while they only amounted to 457 tons in the first quarter of 1868, and to 2 tons in the first quarter of 1867. Although below the corresponding exports effected in the first quarter of 1867, the exports of rails from Belgium to March 31 this year showed an increase of about 3000 tons as compared with the first quarter of 1868. Thus the exports of rails from Belgium in the first quarter of this year was 17,916 tons, against 14,804 tons in the corresponding quarter of 1868, and 22,725 tons in the corresponding quarter of 1867. The exports of Belgian rails to Russia in the first quarter of this year amounted to only 3830 tons, while in the corresponding period of 1868 they were 13,315 tons, and in the corresponding period of 1867, 20,350 tons. As the rail exports from Belgium have declined this year in spite of the falling off indicated in the Russian demand, we may draw the conclusion that the industrial movement has developed itself this year in a more general fashion. Thus the exports of Belgian rails to Italy, which only amounted in the first quarter of last year to 552 tons, rose in the corresponding period of this year to 6546 tons, showing an increase of nearly 6000 tons. Belgian rails were also exported to Turkey in the first three months of this year to the extent of 4484 tons, and to the United States to the extent of 1160 tons, while in the corresponding periods of the years 1868 and 1867 no rail exports were made by Belgium to either of those nations. The exports of iron and plates from Belgium in the first quarter of this year presented a sensible augmentation, having been as follows:—Plates: First three months of 1869, 5082 tons; ditto 1868, 3091 tons; ditto 1867, 3328 tons. Iron: First three months of 1869, 19,256 tons; ditto 1868, 16,599 tons; ditto 1867, 12,775 tons. France remained the most important outlet as regards these two products. The whole of the exports from Belgium of pig, iron, rails, castings, &c., amounted in the first three months of this year to 51,872 tons, against 41,666 tons in the corresponding period of 1868, and 45,868 tons in the corresponding period of 1867. The imports of pig into Belgium show a steady diminution, having amounted in the first quarter of this year to 10,512 tons, as compared with 11,875 tons in the corresponding period of 1868, and 13,855 tons in the corresponding period of 1867. The diminution arose in the imports of English pig. The imports of mineral into Belgium have attained a considerable total this year, having amounted to 90,868 tons, against 63,030 tons in the corresponding period of 1868, and 54,564 tons in the corresponding period of 1867. The state of the Belgian iron markets has not varied materially; puddled bars have become scarce, and have commanded high prices.

The Havre copper market has been in a languishing state. At Paris there has also been some feebleness in the article. The Dutch tin markets have not presented much change; at Rotterdam, Banca was quoted at the last dates at 79 fls. to 79¼ fls. The lead markets are generally stationary. There has not been much doing in zinc, but previous prices have been supported.

Two years ago the Austrian Government forwarded some samples from their steel manufactory to this country, which were pronounced by Birmingham and Sheffield manufacturers as regards quality to be as good, if not better, than the Swedish steel, and far cheaper in price. The chief drawback to its export has been that Austria could not produce sufficient quantities, and that the freight was too high, through the insufficiency of railway communication. The Neuberg and the St. Egydi Kindberger steel manufactories have now been transferred to two joint-stock companies. The purchase-money for the first was subscribed for by a committee of Austrian and English gentlemen, among the latter Mr. Thomas Brassey; the money for the second was contributed by a large number of shareholders, at the head of which stands the Anglo-Austrian Bank. Although these two manufactories are supplied for years with orders for the home trade, large preparations are being entered into, so that in a year or two, when all the branch lines, including the Rodolf Railway, shall have been completed, fresh trials will be made to export to England quantities of Styrian steel, which, it is stated, was in the middle ages considered superior to any in Europe.

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